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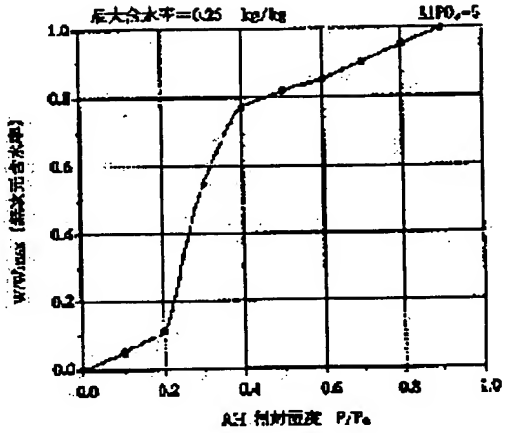
(54) DEHUMIDIFICATION AIR-CONDITIONER

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an energy-saving and compact dehumidification air- conditioner by making up an air-conditioner of a dessicating agent showing a significant difference b tween the adsorption and desorption of moisture, even when it is us d at a regeneration temperature of 50-70° C.
SOLUTION: This dehumidification air-conditioner has a channel for air to b treated by adsorbing moisture with a dessicating agent and a channel for a regenerating air which passes through the dessicating ag nt adsorbing the moisture to desorb the moisture from the agent for regenerating after the regenerating air is heated by a heating source. Thus the treated air and the regenerated air pass through the dessicating agent. In this dehumidification air-conditioner, the d ssicating agent to be used is a porous aluminum phosphate molecular sieve commonly known as AlPO4-n having an essential skeletal structure with a chemical composition of Al2O3: 1.0±0.2 P2O5 as the molar ratio of a oxide.



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* NOTICES *

CLAIMS

[Claim(s)]

[Claim 1] The dehumidification air conditioner characterized by using the porosity aluminium-phosphate system molecular sieve called common-name AlPO4-n which is characterized by providing the following, and which has an indispensable skeletal structure. The path of processing air in which moisture is adsorbed by DESHIKANTO. After being heated by the source of heating, DESHIKANTO after the aforementioned water adsorption is passed and it has the path of the reproduction air which carries out the desorption of the moisture in DESHIKANTO, and is reproduced, and DESHIKANTO is expressed as a mole ratio of an oxide as DESHIKANTO in the dehumidification air conditioner with which it was made for processing air and reproduction air to circulate by turns, and it is the chemical composition of aluminum2O3:1.0**0.2P2O5.

[Claim 2] A porosity aluminium-phosphate system molecular sieve is a dehumidification air conditioner according to claim 1 characterized by being the matter which a hydrated alumina and a phosphoric acid are made to react using a thermal dissociation nature template agent, and is obtained.

[Claim 3] A porosity aluminium-phosphate system molecular sieve is a dehumidification air conditioner according to claim 1 characterized by being the common name AlPO 4-5 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 1.

table 1 2theta d 100xI/I0 7.4-7.6 11.9-11.6 10014. 8-15.3 5.97-5.83 13-4319.7-20.1 4.51-4.42 39-9220.8-21.2 4.27-4.19 37-8722.3-22.7 3.99-3.93 62-11825.9-26.3 3.44-3.39 22-35. [Claim 4] A porosity aluminium-phosphate system molecular sieve is a dehumidification air conditioner according to claim 1 characterized by being the common name AlPO 4-8 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 2.

table 2 2theta d 100xI/I0 5.3-5.4 16.7-16.4 80-100 6.5-6.65 13.6-13.3 30-10019.7-19.8 4.51-4.48 8-2921.2-21.3 4.19-4.17 46-8221.8-21.9 4.08-4.06 14-5622.4-22.9 3.97-3.88 35-39. [Claim 5] A porosity aluminium-phosphate system molecular sieve is a dehumidification air conditioner according to claim 1 characterized by being the common name AlPO 4-11 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 3.

table 3 2theta d 100xI/I0 9.4-9.5 9.41-9.31 31-49 20.5-20.6 4.33-4.31 34-53 21.0-21.25 4.23-4.19 10022. 15-22.25 4.01-4.00 12-58 22.5-22.7 3.95-3.92 47-7523.15-23.5 3.84-3.79 10-68. [Claim 6] A porosity aluminium-phosphate system molecular sieve is a dehumidification air conditioner according to claim 1 characterized by being the common name AlPO 4-16 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 4.

table 4 2theta d 100xI/I0 11.3-11.5 7.83-7.69 59-63 18.7-18.85 4.75-4.71 48-54 21.9-22.2 4.06-4.00 10026.55-26.75 3.36-3.33 23-2729.75-29.95 3.00-2.98 26-30. [Claim 7] A porosity aluminium-phosphate system molecular sieve is a dehumidification air conditioner according to claim 1 characterized by being the common name AlPO 4-20 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 5.

table 5 2theta d 100xI/I 013.9-14.1 6.37-6.28 40-5519.8-20.0 4.48-4.44 40-4824.3-24.5 3.66-3.63 10028. 2-28.3 3.16-3.15 12-2531.4-31.7 2.85-2.82 11-1834.6-34.8 2.59-2.58 15-18. [Claim 8] The dehumidification air conditioner according to claim 1 to 7 characterized by heating reproduction air at 70 degrees C or less, and reproducing DESHIKANTO.

[Claim 9] The dehumidification air conditioner according to claim 8 characterized by cooling the processing air after water adsorption in the low heat source of heat pump, and heating the reproduction air before DESHIKANTO reproduction in the source of high temperature of heat pump.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Technical field to which invention belongs] this invention relates to the dehumidification air conditioner which enabled it to regenerate continuously DESHIKANTO with the reproduction air which started the dehumidification air conditioner, especially was heated by the adsorption treatment and the source of heating of moisture by DESHIKANTO.
[0002]
[Description of the Prior Art] After drawing 10 is heated by the path and the source of heating of the processing air with which moisture is adsorbed by DESHIKANTO, it passes DESHIKANTO after the aforementioned water adsorption, and has the path of the reproduction air which carries out the desorption of the moisture in DESHIKANTO, and is reproduced. It is the conventional technology of a dehumidification air conditioner in which DESHIKANTO was made for processing air and reproduction air to circulate by turns. this The processing air path A, the reproduction air path B, and the DESHIKANTO rotor 103, Two sensible-heat exchangers 104,121, heaters 220, and humidifiers 105 are used as the main configuration equipment. While processing air is dehumidified by the DESHIKANTO rotor 103, it humidifies with a humidifier after carrying out the heat exchange of the processing air which carried out the temperature rise with the water adsorption heat of DESHIKANTO to reproduction air by the 1st sensible-heat exchanger 104 and cooling, and supplying air-conditioning space After taking in reproduction air from outer space (OA), carrying out a heat exchange to processing air and carrying out a temperature rise by the sensible-heat exchanger 104 of the above 1st, It heated by the source 200 of heating with the heater 220, relative humidity was lowered, the DESHIKANTO rotor 129 was passed, and desorption reproduction of the moisture of the DESHIKANTO rotor 129 was carried out. After carrying out the heat exchange and collecting further by the reproduction air before heating a part for the sensible heat of the reproduction air after reproduction, and the 2nd sensible-heat exchanger 121, it constituted from this conventional example so that it might emit outside (EX). Such technology has high practical use value as technology which is called so-called DESHIKANTO air-conditioning and can control the humidity of air-conditioning space.
[0003] Although it is known as DESHIKANTO used for such DESHIKANTO air-conditioning that silica gel and a zeolite (molecular sieve) will be used as indicated by the U.S. patent USP No. 5,052,188 In the U.S. patent USP No. 5,052,188 It is a conversion zeolite, and is classified into Type 1 of bull NAUA, and the isothermal separation factor (separation factor) is indicated to be the the best for the DESHIKANTO air-conditioning machine with which the thing of the range of 0.07-0.5 heats reproduction air by combustion gas. Although using a zeolite for USP No. 3,844,737 is indicated as well-known data about the DESHIKANTO material for DESHIKANTO air-conditioning machines which heats reproduction air by this kind of combustion gas, there is no suggestion about an adsorption property in addition to the aforementioned U.S. patent USP No. 5,052,188. Moreover, under the environment of high humidity, although the lithium chloride might be used for in the past as moisture absorption matter, since there is deliquescence and there is a fault which drops out of Rota, it is no longer used gradually.
[0004]
[Problem(s) to be Solved by the Invention] In the above Prior arts, in the DESHIKANTO air-conditioning machine which heats reproduction air by combustion gas, the reproduction temperature of DESHIKANTO is boiled the aforementioned U.S. patent USP No. 5,052,188, and it sets. 101 degrees C (215 degrees F) USP No. 3,889,742 is described to be 143 degrees C (290 degrees F). A zeolite is suitable as suitable DESHIKANTO for such reproduction temperature. It is indicated by the aforementioned U.S. patent USP No. 5,052,188 that it is optimal to have the adsorption property by which an isothermal separation factor (separation factor) is shown by the adsorption isotherm of the range of 0.07-0.5 as shown especially in drawing 11 . However, since the direction made into 65-75 degrees C has many heat sources which can be used as for reproduction temperature when it is going to use various exhaust heat and solar heat as a reproduction heat source of DESHIKANTO, although it is easy to put in practical use, in such a case, it is classified into Type 1 of aforementioned bull NAUA, and the zeolite of the range of 0.07-0.5 does not necessarily have the optimal isothermal separation factor (separation factor). Drawing 11 is used for below and a reason is explained to it.
[0005] Drawing 11 is the adsorption isotherm of the zeolite indicated by the U.S. patent USP No. 5,052,188. When using the open air for DESHIKANTO air-conditioning as reproduction air, generally in a summer, the absolute humidity assumes kg in about 20-21g /by this contractor that is in charge of an air-conditioning design. If such air is heated aforementioned] to 101 degrees C, the relative humidity will become about 3.0%. On the other hand, the relative humidity of the processing air adsorbed has the dry-bulb temperature of 27 degrees C, and the common wet-bulb temperature of 19 degrees C from the indoor conditions specified in the JIS-C9612 grade of an air conditioner, and the relative humidity at that time is about 50%. DESHIKANTO contacts between 50% of processing air, and 3.0% of processing air by turns in this way. Reproduction air is contacted, and it considers as the constant-temperature-line separation factor R= 0.1 using the function expressed with formula X=P/(R+P-R-P), and as shown in drawing 11 , if the moisture content of the zeolite when balancing is calculated as P= 0.030 when relative humidity is 3.0%, it will be set to X= 0.236.
[0006] On the other hand, the processing air from the interior of a room is contacted, and similarly, if moisture content of the zeolite when balancing is used as the constant-temperature-line separation factor R= 0.1 and is calculated as P= 0.5, it will be set to X= 0.910. Therefore, when heating reproduction air to 101 degrees C using a zeolite, in DESHIKANTO, the adsorption and desorption of the with a value [of 0.169kg/kg] which multiplied

0.910-0.236=0.674 which are th differenc of the r lativ amount of adsorption by the 0.25kg [/kg] maximum amount f ads rpti n moisture can be carried out. When an adsorption isoth rm uses a material with a lin ar (isoth rmal separation factor R= 1) pr perty like silica gel, as well as the difference of relative humidity, the diff r nce of the amount of adsorpti n and desorption is set to 0.500-0.030=0.470, and stops [kg] in 0.470 tim s /of the maximum am unt of adsorption (usually about 0.3kg/(kg)), i. ., 0.14kg. Th r for , in this exampl , the z olit is mor advantag us. Thus, like 101 degrees C r production temp rature was indicat d to be in the c nv ntional xample, when high, it was advantag ous t hav used a z lit . How v r, if it calculat s about the case wh re it is the reproduction temperature of 50-70 degr es C to which this invention targets the difference f th same adsorpti n and desorption, while the predominance of a zeolite will diminish, the difference of adsorption and desorption falls greatly. It explains below.

[0007] Drawing 12 is the conventional technology which the artificer indicated as drawing 3 by JP,9-196482,A. After b ing heated by the path and the source of heating of the processing air with which moisture is adsorbed by DESHIKANTO, pass DESHIKANTO after the aforementioned water adsorption and it has the path of the reproduction air which carries out the desorption of the moisture in DESHIKANTO 103, and is reproduced. It is the dehumidification air conditioner with which DESHIKANTO 103 was made for processing air and reproduction air to circulate by turns, and the processing air after water adsorption is cooled in the low heat source 240 of heat pump, and the reproduction air before DESHIKANTO reproduction is heated in the source 220 of high temperature of heat pump. Drawing 13 is the psychrometric chart showing an operation of the air conditioner of drawing 12 .

[0008] Thus, since air supply SA (state N) can be made into low temperature as shown in the psychrometric chart of drawing 13 rather than the interior of a room (state K) when cooling the processing air after water adsorption in the low heat source 240 of heat pump, it is not necessary to use the humidifier 105 used by drawing 10 , therefore absolute humidity of the air after dehumidification is made the same as the absolute humidity of air supply (SA) by DESHIKANTO 103, and it can do more highly than the operation form of drawing 10 . So that it may be well-known for this contractor therefore, on the air-conditioning conditions of a summer As shown in drawing 13 , when the absolut humidity of air supply, i.e., the humidity of the processing air after dehumidification, is set [kg] up in 7g /in consideration of air supply being performed by kg in 8g /or less, usually, processing air condition change Air carries ut the change of state of this enthalpy line top from an indoor state to 7g/kg, and results in the state of 20% of relative humidity so that it may be well-known (like a zeolite, when a heat of adsorption is large, it results in the state f 20% of relative humidity in kg in 8g /with absolute humidity high a little).

[0009] It is well-known to this contractor that the relative humidity of the processing air after such adsorption and th relative humidity of the reproduction air before reproduction are respectively equal on the other hand (for xample, indicated by data P23-25 of the TC3.5/short course seminar held at the time of the 1997 annual meetings of th U.S. ASHRAE society). Therefore, reproduction air can make DESHIKANTO generate dehumidification capacity by heating outdoor air to this relative humidity.

[0010] That is, since the absolute humidity of the general open air of a summer is 15g/kg, if this air is heated to 50 degrees C, it can be used as reproduction air of 20% of relative humidity. Although open air absolute humidity may rise t 20g/kg rarely, if it heats to 55 degrees C such even case, DESHIKANTO can be made to be able to generate d humidification capacity, processing air can be dehumidified, and it can charge by kg in 8g /or less. Therefore, at the air c nditioner of such composition, although DESHIKANTO with the large adsorption capacity force is desirable, as it was shown below at the reproduction temperature of about 50-70 degrees C, with the conventional zeolite, the diff rence of the moisture content (water content) of adsorption and desorption was small, therefore there was a fault t which DESHIKANTO becomes large with the conventional technology.

[0011] That is, if reproduction air with an absolute humidity of 15g [/kg] is heated to 50 degrees C, the relative humidity will become about 20% (correctly 18.9%). Therefore, reproduction air is contacted, and if the moisture content of the zeolite of the aforementioned constant-temperature-line separation factor R= 0.1 when balancing is calculat d as P= 0.2 when relative humidity is 20%, as shown in drawing 11 , it will be set to X= 0.71. On the other hand, the proc ssing air from the interior of a room is contacted, and if the moisture content of this zeolite when balancing is th same as the above and is calculated as P= 0.5, it will be set to X= 0.91. Therefore, although both difference is taken and the adsorption and desorption of one 0.20 times the moisture of 0.05kg/kg of 0.91-0.71=0.20 [0.25kg //kg], i.e., the maximum amount of adsorption, can be carried out in DESHIKANTO when heating reproduction air to 50 d gr es C using this zeolite, compared with the value of 0.169kg/kg when reproduction temperature is high as mentioned above, it becomes 1/3.4, therefore 3.4 times larger DESHIKANTO is needed compared with the former.

[0012] Drawing 14 expresses the absolute humidity of air for the relation of the water content of the air temperatur which contacts, and a zeolite as a parameter using the adsorption-isotherm property of drawing 11 . A points show th quilibrium point of an adsorption start, i.e., indoor air, among drawing, and D50 and D70 point show the equilibrium point of a desorption start, i.e., a reproduction start, i.e., reproduction air. The difference of adsorption desorption consists in 0.05kg [kg] /by 50-degree-C reproduction, and consists also of this drawing 14 in 0.11kg/kg by 70-degree-C reproduction, and it turns out that DESHIKANTO which contained many desiccants 3.4 to 1.5 times rather than before is needed.

[0013] When an adsorption isotherm on the other hand uses a material like silica gel with a linear (isothermal s paration factor R= 1) property In 50-degree-C reproduction, the difference of the amount of adsorption and d sorption is set to 0.5-0.2=0.3 as well as the difference of relative humidity. It can perform, 0.3 times, i.e., the 0.09kg [/kg] adsorption and desorption, of the 0.3kg/kg of the maximum amounts of adsorption. moreover, the case of 70-degree-C reproduction (7.5% of relative humidity) -- 0.5-0.075=0.425 -- becoming -- 0.425 times [/kg], i.e., 0.127kg, as many adsorption and desorption of the 0.3kg/kg of the maximum amounts of adsorption as this -- it can do -- 0. of the aforementioned zeolite shell, although it turns around 05 and 0.11 on ach Ev n in this case, DESHIKANTO which contain d many d siccants compared with th value of 0.14kg/kg conv ntionally is n eded.

[0014] thus, in a Prior art, th re was a fault to which DESHIKANTO containing a lot of d siccants is ne d d when using it at th reproduction temperature of 50-70 degr es C, ther for th appearance of DESHIKANTO becom s large and in which it accumulates, and an air-conditioning machin b comes large, and cost also increases .

[0015] Wh n it was mad in vi w of the point mentioned above and us s it at th reproduction temperature f 50-70 d gre s C, using DESHIKANTO which can take th large diff r nc of the adsorption and d sorption of moistur , by constituting an air conditioner, this invention is nergy saving and aims at offering a compact dehumidification air condition r.

[0016]
[Means f r Solving the Problem] The path of proc ssing air in which moistur is ads rbed to invention according t claim 1 by DESHIKANTO, In the dehumidificati n air conditioner with which pass DESHIKANTO after the aforem ntioned water adsorption, and have the path of th r pr duction air which carries out the des rpti n of the moisture in DESHIKANTO, and is reproduc d after b ing heated by th source of h ating, and DESHIKANTO was made for pr cessing air and repr ducti n air to circulate by turns It is th dehumidification air c nditi n r characterized by having expressed as a mole ratio of an oxide and using the por sity aluminium-ph sphat system molecular si v called common-name AlPO4-n which has th indispensabl skeletal structure which has the chemical composition of aluminum2O3:1.0**0.2P2O5 as DESHIKANTO.
[0017] Thus, using as DESHIKANTO the phosphoric-acid aluminum system molecular sieve which has a suitable property for the reproduction temperature of 50-70 degrees C, by constituting an air conditioner, it is energy saving and a compact dehumidification air conditioner can be offered.
[0018] Invention according to claim 2 is a dehumidification air conditioner according to claim 1 characterized by a porosity aluminium-phosphate system molecular sieve being matter which hydrated aluminas (for example, an aluminum hydroxide, a boehmite, a pseudo-boehmite, etc.) and a phosphoric acid are made to react using a thermal dissociation nature template agent (for example, an organic base like tripropylamine), and is obtained. Thus, by using the manufactured porosity aluminium-phosphate system molecular sieve for DESHIKANTO, DESHIKANTO which has a suitable property for the reproduction temperature of 50-70 degrees C is obtained, it is energy saving and a compact dehumidification air conditioner can be offered.
[0019] Invention according to claim 3 is a dehumidification air conditioner according to claim 1 characterized by a p rosity aluminium-phosphate system molecular sieve being the common name AlPO 4-5 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 1. Invention according to claim 4 is a d humidification air conditioner according to claim 1 characterized by a porosity aluminium-phosphate system m l cular sieve being the common name AlPO 4-8 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 2.
[0020] Invention according to claim 5 is a dehumidification air conditioner according to claim 1 characterized by a p r sity aluminium-phosphate system molecular sieve being the common name AlPO 4-11 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 3. Invention acc rding to claim 6 is a dehumidification air conditioner according to claim 1 characterized by a porosity aluminium-phosphate system molecular sieve being the common name AlPO 4-16 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 4.
[0021] Invention according to claim 7 is a dehumidification air conditioner according to claim 1 characterized by a p r sity aluminium-phosphate system molecular sieve being the common name AlPO 4-20 which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 5. Thus, using the p rosity aluminium-phosphate system molecular sieve called various kinds of AlPO4-n which has the pore near the m l cular diameter of water and has a suitable property for the reproduction temperature of 50-70 degrees C as DESHIKANTO, by constituting an air conditioner, it is energy saving and a compact dehumidification air conditioner can be offered.
[0022] Invention according to claim 8 is a dehumidification air conditioner according to claim 1 to 7 characterized by heating reproduction air at 70 degrees C or less, and reproducing DESHIKANTO. Thus, a dehumidification air c nditioner [**********] can be offered reproducing DESHIKANTO at the reproduction temperature doubled with the adsorption property of DESHIKANTO, and by using a comparatively low drive heat source.
[0023] Invention according to claim 9 is a dehumidification air conditioner according to claim 8 characterized by cooling the processing air after water adsorption in the low heat source of heat pump, and heating the reproduction air b f re DESHIKANTO reproduction in the source of high temperature of heat pump. Thus, since multiplex use-ization of the drive energy of heat pump is attained and can moreover make the temperature lift of this heat pump small by taking heat from the processing air after water adsorption, and using the heat for reproduction of reproduction air again by heat pump, a dehumidification air conditioner [**********] can be offered.
[0024]
[Embodiments of the Invention] Hereafter, the operation form of the dehumidification air conditioner concerning this invention is explained. the 1st operation form of this invention — as DESHIKANTO — a hydrated alumina (for xample, an aluminum hydroxide —) It is the porosity aluminium-phosphate system molecular sieve which a boehmit , a ps udo-boehmite, etc. and a phosphoric acid are made to react using the template agent (for example, an organic bas like tripropylamine) of thermal dissociation nature, and is obtained. Express as a mole ratio of an oxide and it has th indispensable skeletal structure which has the chemical composition of aluminum2O3:1.0**0.2P2O5. And the porosity aluminium-phosphate system molecular sieve which has the characteristic X-ray powder diffraction pattern which contains at least d-interval shown in Table 1 (as indicated by JP,1-57041,B) It is a dehumidification air conditioner (for example, dehumidification air conditioner which has the configuration indicated to drawing 12) using what is called the common name AlPO 4-5 at the union carbide company and the society. Artificers measured the ads rption property of this porosity aluminium-phosphate system molecular sieve (common name AlPO 4-5), and obtained the following result.
[0025] Drawing 1 is the adsorption isotherm of the measured porosity aluminium-phosphate system molecular sieve (AlPO 4-5), and the relative amount of adsorption (relative moisture content) which a horizontal axis makes the amount of adsorption at the time of 90% of humidity of each DESHIKANTO (the maximum amount of adsorption) as relative humidity, and a vertical axis makes it a denominator, and defines the amount of adsorption as a molecule is shown. Th wat r content at the tim f th adsorption prop rty f 24 degrees C of the moisture indicat d by Example 55 in aforementioned JP,1-57041,B, i.e., temperature, and pr ssure 4.6Torr (20% f r lative humidity) is 4.6kg/kg, and th property of drawing 1 coincides with th t mp ratur of 23 d gr s C, and the prop rty that th water cont nt at th tim of pr ssure 18.5Torr (88% of r lativ humidity) is 26.4kg/kg, and has the featur t which a water content chang s from 40% of relative humidity a lot among 20% sp cially Moreover, such a featur is rep rted by th society. For xample, it is reported as Fig.4 into P subj ct "Adsorption Properties of Microp rous Aluminophosphate AlPO 4-5" of the collected works "New Dev lopments in Zeolot Science & T chnology" of International Z olite Confer nc of 1986 holding given in 539-546.
[0026] Drawing 2 express s th absolute humidity of air for th r lation of the water cont nt of th air t mp ratur

which contacts, and a porosity aluminium-phosphate system molecular sieve (AlPO 4-5) as a parameter using the adsorption isotherm of drawing 1 . A points show the equilibrium point f an adsorption start, i.e., indoor air, among drawing, and D50 and D70 point show the equilibrium point of a desorption start, i. ., a reproduction start, i. ., reproduction air. As for the diff rence of the water content of adsorption and d sorption, drawing 2 shows that the differ nce of 0.19kg [/kg] adsorption desorption is acquired by 0.17kg [kg] /and 70-degre -C reproduction by 50-degree-C r production. The sam dehumidification effect can be generated also at low-temperatur r production t mperatur using DESHIKANTO of th weight larg r [than the zeolit or silica gel of the aforementioned former] this value and almost sam as th z olit which was b ing conv ntionally reproduced abov 100 degr es C.

[0027] The dehumidification air conditioner of the configuration indicated to drawing 12 about the operation of the d humidification air conditioner of this invention is explained below with reference to drawing 13 which is the psychrometric chart showing air condition change. Moisture is adsorbed (state L), and by the 1st sensible-heat exchanger 104, a heat exchange is carried out to reproduction air (state Q), and it is cooled by the DESHIKANTO rotor 103 (state M), it is further cooled in the low heat source 240 of heat pump, and processing air (state K) returns to the air-conditioning (state N) space 101. On the other hand, reproduction air takes in the open air (state Q), by the 1st sensible-heat exchanger 104, carries out a heat exchange to processing air (state L), is heated (state R), further, the heat exchange of it is carried out, is heated (state S), is heated in the source 220 of high temperature of heat pump (heater) by the reproduction air after DESHIKANTO reproduction (state U), and the 2nd sensible-heat exchanger 121, (state T), and reproduces the DESHIKANTO rotor 103 after **. By the sensible-heat exchanger 121 of th above 2nd, the reproduction air (state U) which reproduced DESHIKANTO carries out a heat exchange to the reproduction air which came out of the 1st sensible-heat exchanger 104, and heat recovery is carried out (state V), and it is thrown away outside as exhaust air after **. Thus, absolute-humidity difference deltaX and enthalpy diff rence deltaQ are made to produce between the interior of a room (state Q) and air supply (state N), and the air conditioning dehumidification effect is generated. Moreover, the drive energy of this equipment is the heating value which lengthened amount of heating deltaG to the aforementioned deltaQ of reproduction air, and in order that it may reproduce DESHIKANTO by exhaust heat of the sensible-heat processing from State M to State N, the energy-saving ff ct is very large [energy].

[0028] Since air-supply (state N) temperature can be made lower than the interior of a room (state K) in the dehumidification air conditioner which acts as mentioned above, humidification is unnecessary. On the other hand, although it is performing humidifying to the processing air after dehumidification for sensible-heat processing, th r fore the moisture of the amount beyond the humidity difference of original air supply and indoor air needed to d humidify, since there are few the amounts of DESHIKANTO of net dehumidification and it ends with the c nventional DESHIKANTO air-conditioning when a humidifier is omissible like drawing 12 , by it, the same air conditioning dehumidification effect can demonstrate by DESHIKANTO fewer than the conventional technology r latively.

[0029] Thus, with this operation form, since the large difference of adsorption and desorption can be taken and many moisture processings can do it in few DESHIKANTO even when reproduction temperature is low, it ends with a compact DESHIKANTO rotor. Moreover, since the temperature (state T) of reproduction air can be low set up with 50-55 degrees C, the operative temperature (condensation temperature) of the source 220 of high temperature of the h at pump which is the source of heating is low, and it ends, therefore there is little power of a heat pump compressor and it ends. Therefore, compared with the former, it excels in energy-saving nature and a compact air conditioner can b offered.

[0030] In addition, although this operation form showed the example which uses AlPO 4-5 as a porosity aluminium-phosphate system molecular sieve, many isomers exist in the porosity aluminium-phosphate system molecular sieve called this AlPO4-n as indicated by aforementioned JP,1-57041,B. Adsorption of the water by the mol cular sieve is the phenomenon of adsorbing larger pore than a moisture child's diameter as an adsorption site, and adsorption intensity is influenced also with the attraction of the metal ion which exists in an adsorption site so that it may be well-known. However, since a metal ion (for example, alkali metal and alkaline earth metal, such as sodium and a potassium) with attraction strong against the adsorption site of the porosity aluminium-phosphate system molecular sieve called this AlPO4-n does not exist, an adsorption property has the very large influence by the diameter of pore. Th refore, since an effect with the same said of the matter which has the same pore size as AlPO 4-5 in the porosity aluminium-phosphate system molecular sieve called AlPO4-n is acquired, even if it uses these isomers as DESHIKANTO, it does not interfere.

[0031] For example, having I/I0 strong property by the JP,1-57041,B table 2, applying [4-5] it to 3.93-4.51 at int rvals of d- is indicated, and the matter of the following [isomer / which has such a property] in addition to this is indicated by JP,1-57041,B.

1) It is indicated that AlPO 4-8 is missing from 4.17-4.19 at intervals of d-, and having I/I0 strong property is indicated in Table 4, and high water adsorption nature is in example 62-A.

2) It is indicated that AlPO 4-11 is missing from 4.19-4.23 at intervals of d-, and having I/I0 strong property is indicated in Table 8, and high water adsorption nature is in Example 63.

3) It is indicated that AlPO 4-16 is missing from 4.00-4.06 at intervals of d-, and having I/I0 strong property is indicated in Table 13, and high water adsorption nature is in Example 60.

4) It is indicated that AlPO 4-20 is missing from 3.63-3.66 at intervals of d-, and having I/I0 strong property is indicated in Table 19, and high water adsorption nature is in Example 58.

[0032] Drawing 3 is the 2nd operation gestalt of this invention. The operation gestalt of drawing 3 is the dehumidification air conditioner of the so-called hybrid type which combined DESHIKANTO and heat pump like drawing 12 , and is what r moved the 1st sensible-heat xchanger 104 from the composition of drawing 12 , and th porosity aluminium-phosphate system molecular sieve called common-nam AlPO4-n by DESHIKANTO 103 of this basic composition as w ll as th operation g stalt of the above 1st is used for it. Thus, in th constitut d air conditioner, since the heat exchange of processing air and r production air is not performed, th charg air temp ratur of processing air is the optimal dehumidification air conditioner for the use to which the so-call d sensible heat factor made small dehumidification the subject by becoming high. An operation is explained b low with reference to drawing 4 which is a psychrometric chart corresponding to drawing 3 .

[0033] Moisture is adsorbed (state L), it is further cooled by the DESHIKANTO rotor 103 in th source 240 of the low fever of heat pump, and processing air (state K) returns to th air-conditioning (state N) space 101 by it. On th oth r

hand, reproduction air takes in the open air (state Q), by the reproduction air (state U) and the s nsible-heat xchang r 121 after DESHIKANTO reproduction, th heat exchang of it is carried out, is heated (state S), is heated in the sourc 220 of high temperature of heat pump (heater) (state T), and reproduc s the DESHIKANTO rotor 103 aft r **. By th aforem ntioned s nsible-heat exchanger 121, the reproduction air (state U) which r produced DESHIKANTO carries out a heat exchange to th reproduction air which came out of the 1st sensible-heat xchanger 104, and heat recovery is carried out (state V), and it is thrown away outsid as exhaust air after **. Thus, absolut -humidity difference deltaX and nthalpy differ nce d ltaQ are made to produce between th interior of a room (stat K) and air supply (stat N), and the air conditioning dehumidification effect is generated. Compared with the operation gestalt of the above 1st, a charge air temperature becomes high, and since it is close to the degree of room air temperature, this operation gestalt has it for the air-conditioning load (latent heat load) which makes dehumidification a subject. [optimal] Moreover, if a charge air temperature is made into the same about 27 degrees C as the interior of a room in this case, the difference with 50 degrees C of reproduction air temperature and a charge air temperature will become only 23 degrees C. Therefore, since the temperature lift which is the temperature gradient of the source of the low fever of heat pump and the source of high temperature becomes 33 degrees C which added about 10 degrees C to it and heat pump can be operated by the low temperature lift compared with the air conditioning method by the conventional steamy compression equation cycle, It is energy-saving-like, and in order that the water of condensation (drain) moreover may not come out, it is effective in a facility becoming easy. Still lik th 1st operation gestalt, since many moisture processings can be performed in few DESHIKANTO, it ends with a compact DESHIKANTO rotor. Therefore, compared with the former, it excels in energy-saving nature and a compact dehumidification air conditioner can be offered.

[0034] Drawing 5 is the 3rd operation gestalt of this invention. The operation gestalt of drawing 5 is the dehumidification air conditioner of the so-called hybrid type which combined DESHIKANTO and heat pump like drawing 3 , and a different portion from the composition of drawing 3 is a point using [using the mixed air of the open air and the return air from the interior of a room as processing air] the mixed air of the exhaust air from the interior of a room, and the open air as reproduction air. Therefore, while forming the path 161 and blower 160 for mixing th op n air between the processing air path 107 and the open air introduction path 124 in addition to the composition of drawing 3 , the path 162 for mixing a return air is established between the reproduction air path 124 and the return-air path 107. Thus, although it is necessary to make reproduction air temperature high a little in the constituted air conditioner in order to maintain [kg] the humidity of air supply in 7g /as well as the aforementioned operation gestalt since the absolute humidity of the adsorption start point by DESHIKANTO of processing air becomes higher than th ind or state of JIS, according to DESHIKANTO of this invention, an effect of the invention is obtained like the aforementioned example. The relation of the water content of drawing 6 which is a psychrometric chart corresponding to drawing 5 , the air temperature which contacts, and a porosity aluminium-phosphate system molecular sieve (AlPO 4-5) is explained below with reference to drawing 7 which expressed the absolute humidity of air as a parameter.

[0035] Processing air (state K) is mixed air (state F) of the open air (state Q) and the return air (state K) from the int rior of a room, and moisture is adsorbed (state L), it is further cooled by the DESHIKANTO rotor 103 in the sourc 240 of the low fever of heat pump, and it returns to the air-conditioning (state M) space 101 by it. On the other hand, r production air is mixed air (state g) of the open air (state Q) and a return air (state K), by the reproduction air (stat U) and the sensible-heat exchanger 121 after DESHIKANTO reproduction, the heat exchange of it is carried out, it is h at d (state S), is heated in the source 220 of high temperature of heat pump (heater) (state T), and reproduces th DESHIKANTO rotor 103 after **. By the aforementioned sensible-heat exchanger 121, the reproduction air (state U) which reproduced DESHIKANTO carries out a heat exchange to the reproduction air which came out of the 1st sensible-heat exchanger 104, and heat recovery is carried out (state V), and it is thrown away outside as exhaust air aft r **. Thus, absolute-humidity difference deltaX and enthalpy difference deltaQ are made to produce between the int rior of a room (state K) and air supply (state M), and the air conditioning dehumidification effect is generated.

[0036] Since this operation gestalt mixes the open air to air supply and can supply it indoors compared with the operation gestalt of the above 2nd, it is the the best for indoor-environment maintenance. In this case, when the int rior of a room is assumed to be 27 degrees C and 50%RH and the open air is assumed to be 33 degrees C and 63%RH supposing the daytime at the time of midsummer, as each air condition is shown in drawing 6 , since it is mix d with the open air with an absolute humidity of 20g [/kg], the processing air in front of DESHIKANTO 103 serves as dry-bulb temperature of 29 degrees C, and absolute humidity of 13g/kg. Therefore, if it moves to a line with an absolute humidity of 7g [/kg] along with an enthalpy [absorption / of DESHIKANTO] line, the relative humidity of State L will become about 10% (correctly 11%). Therefore, it is necessary to make temperature of a reproduction start of reproduction air into 65 degrees C like the above-mentioned from the intersection of the line of 10% of relative humidity, and a line with an absolute humidity [of reproduction air] of 17g [/kg]. On the other hand, since it is mix d with a return air with an absolute humidity of 10g [/kg] and the reproduction air before DESHIKANTO 103 reproduction serves as dry-bulb temperature of 31 degrees C, and absolute humidity of 17g/kg, the state of the stat T of a reproduction start serves as dry-bulb temperature of 65 degrees C, and absolute humidity of 17g/kg. As the diff rence of the adsorption and desorption of DESHIKANTO by the state F of such an adsorption start point (dry-bulb temperature of 29 degrees C, absolute humidity of 13g/kg) and the state T of a reproduction start point (dry-bulb temperature of 31 degrees C, absolute humidity of 17g/kg) is shown in drawing 7 , it becomes in kg and 0.19kg /, and a big value is acquired like aforementioned drawing 2 . In addition, with this operation gestalt, since it is the same as that of the operation gestalt of the above 2nd about the operation in each device of processing air and r production air, explanation is omitted.

[0037] Thus, since the large difference of adsorption and desorption can be taken and many moisture processings can do it in f w DESHIKANTO wh n reproduction t mperature needs to be highly set up a little to about 65 degrees C, in order to p rform open air introduction, it ends with a compact DESHIKANTO rotor. Moreover, since the temperature (state T) of reproduction air can be set up low, the operative temperature (condensation temperature) of th source 220 of high temperatur of the heat pump which is the sourc of heating is low, and it ends, therefor ther is littl power of a heat pump compressor and it ends. Therefor , compared with the former, it excels in energy-saving natur , and a compact air conditioner can be offered.

[0038] Drawing 8 is the 4th operation gestalt of this inv ntion. The operation gestalt of drawing 8 is the so-called desiccant air conditioner which does not use heat pump like drawing 10 , and a different portion from the composition of drawing 10 is constitut d so that it may cool with a heat exchanger 104 using the open air humidified with the

humidifier 105 as an obj ct for the processing air cooling aft r d humidification, and it does not carry out th heat xchange f r producti n air and the pr cessing air. Although the heat exchange was conventionally carried ut to proc ssing air with this kind of equipment sinc it humidified to reproduction air and dry-bulb temperature was reduced If it does s , th absolute humidity f repr duction air rises, and although ther was a problem t which the heating temp rature of r production air bec mes high in order to heat reproduction air and to obtain th same relativ humidity as the proc ssing air after dehumidification, as mentioned above By using another c oling air system as an bject for proc ssing air cooling like this operation gestalt, such a troubl is avoidable. With reference to drawing 9 which is a psychrometric chart corresponding to drawing 8 , it explains below.

[0039] Moisture is adsorbed (state L), it is cooled by the DESHIKANTO rotor 103 with the condensator 104 by the pen air humidified further, and processing air (state K) returns to the air-conditioning (state M) space 101 by it. On the other hand, reproduction air takes in the open air (state Q), by the reproduction air (state U) and the sensible-heat exchanger 121 after DESHIKANTO reproduction, the heat exchange of it is carried out, is heated (state S), is heated in a heater 220 (state T), and reproduces the DESHIKANTO rotor 103 after **. By the aforementioned s nsible-heat exchanger 121, the reproduction air (state U) which reproduced DESHIKANTO carries out a heat xchange to the reproduction air which came out of the 1st sensible-heat exchanger 104, and heat recovery is carri d out (state V), and it is thrown away outside as exhaust air after **. Moreover, with the heat of vaporization of wat r, after **, cooling air takes in the open air (state Q), and a heat exchange is carried out to processing air (state L) with a heat exchanger 104, and a temperature fall is carried out with a humidifier 105 (state D), and it is itself thr wn [a temperature rise is carried out (state E) and] away outside as exhaust air after **.

[0040] Thus, absolute-humidity difference deltaX is made to produce between the interior of a room (state K) and air supply (state N), and the dehumidification effect is generated. This operation gestalt can respond to the air-c nditioning load (latent heat load) which makes dehumidification a subject, without increasing an indoor sensible h at load not much, in order that a charge air temperature may become low and may approach the degree of room air temperature compared with the conventional operation gestalt. Generally, the mean temperature of a summer is about 28 d grees C, and since it hardly changes with the degree of room air temperature, even if it is the composition of not using a humidifier for a processing air system in this way, it can dehumidify the interior of a room, without increasing a s nsible heat load. Therefore, a latent heat load can be processed instead of the air conditioning method by the conv ntional steamy compression equation cycle using 50-70-degree C exhaust heat or solar heat, and still like the 1st operation gestalt, since many moisture processings can be performed in few DESHIKANTO, it ends with a compact DESHIKANTO rotor. Therefore, compared with the former, it excels in energy-saving nature and a compact dehumidification air conditioner can be offered.

[0041]

[Effect of the Invention] according to [as explained above] this invention -- a hydrated alumina (for example, an aluminum hydroxide --) The porosity aluminium-phosphate system molecular sieve which a boehmite, a ps udo-boehmite, etc. and a phosphoric acid are made to react using the template agent (for example, an organic bas like tripropylamine) of thermal dissociation nature, and is obtained Since the difference of the amount of water adsorption by the adsorption and desorption of DESHIKANTO uses greatly by constituting a dehumidification air conditioner, using (for example, common-name AlPO4-n in a union carbide company and a society) as DESHIKANTO, An air conditioner can be comparatively driven in the heat source of low temperature compared with the former, and it is large, and it is energy saving and the air conditioning effect can offer a compact and cheap dehumidification air conditioner.

[Translation done.]